

What is claimed is:

1. A rapid resin or pitch transfer molding apparatus, which apparatus comprises:

means for melting and conveying a resin or pitch;

5 a mold arranged so that melted resin or pitch is conveyed from the melting and conveying means into an annular mold cavity within a removable insert in the molding apparatus, wherein said insert comprises means for effecting flow of the resin or pitch from the top and bottom of the mold cavity to vents located in the center of the mold cavity, at the  
10 top and/or bottom of the mold cavity, and/or annularly around the mold cavity; and

means disposed at the mold to constrain the mold during supply of the resin or pitch into the mold.

2. The rapid resin or pitch transfer molding apparatus of claim  
15 1, wherein said removable mold insert is configured to produce a brake disc for an aircraft landing system.

3. The rapid resin or pitch transfer molding apparatus of claim 1, wherein the removable mold insert comprises:

a top half that includes an annular groove;

20 a bottom half that includes an annular groove opposed to the top half annular groove, so that the top half groove and the bottom half groove form an annular mold cavity;

a plurality of melt supply channels disposed in the top half and in the bottom half of the mold, wherein said melt supply channels are  
25 arranged to operatively communicate with the annular mold cavity formed by the removable insert;

valves, wherein the valves can admit resin or pitch into the melt supply channels in the top half and the bottom half of the mold; and

an arrangement for venting and/or providing a vacuum to the annular mold cavity.

4. The rapid resin or pitch transfer molding apparatus of claim 3, wherein the annular mold cavity is partially defined by an inner step  
5 ring and an inner locator ring.

5. The rapid resin or pitch transfer molding apparatus of claim 3, wherein the annular mold cavity is partially defined by an outer step ring and an outer locator ring.

6. The rapid resin or pitch transfer molding apparatus of claim  
10 3, comprising a centrally located inner vent port and a plurality of annularly located outer vent ports.

7. A rapid resin or pitch transfer molding process, comprising the steps of:

15 arranging a porous preform, at a temperature above a melting point of a resin or pitch to be transferred into the preform, in an annular mold cavity defined by a top half that includes an annular groove and a bottom half that includes an annular groove opposed to the top half annular groove, so that the top half and the bottom half annular grooves together form said annular mold cavity , wherein a plurality of melt supply channels  
20 is disposed in the top half and in the bottom half of the mold to operatively communicate with said annular mold cavity, wherein valves are operated to admit resin or pitch into the melt supply channels in the top half and the bottom half of the mold, and wherein said annular mold cavity is provided with an arrangement for venting and/or providing a  
25 vacuum thereto;

effecting flow of the resin or pitch from channels located in the top and bottom of the mold cavity through the body of the preform located in the mold cavity to vents located in the center of, at the top and/or bottom

of, and/or annularly around the mold cavity, in order to effect impregnation of the preform;

cooling the resulting resin-infiltrated or pitch-infiltrated preform to below the melting point of the resin or pitch; and

5 removing the impregnated preform from the mold.

8. The rapid resin or pitch transfer molding process according to claim 7, wherein the preform is selected from the group consisting of fibrous preforms, carbon fiber preforms, nonwoven preforms, random fiber preforms with binder, rigidized preforms, and foam preforms.

10 9. The rapid resin or pitch transfer molding process according to claim 8, wherein the preform is a porous carbon body.

10. The rapid resin or pitch transfer molding process of claim 9, wherein said preform is configured as a brake disc for an aircraft landing system.

15 11. The rapid resin or pitch transfer molding process according to claim 7, wherein the preform is heated to a temperature between about 100 through about 425°C.

20 12. The rapid resin or pitch transfer molding process according to claim 7, wherein the mold is heated to a temperature between about 100 through about 310°C.

13. The rapid resin or pitch transfer molding process according to claim 7, wherein the resin or pitch is a member selected from the group consisting of synthetic pitch, coal tar pitch, petroleum pitch, mesophase pitch, high char yield thermoset resin, and combinations thereof.

25 14. The rapid resin or pitch transfer molding process according to claim 7, in which multiple preforms are placed in a single mold.

15. The resin transfer molding process according to claim 7, which further comprises carbonization of the oxidized impregnated preform.

5 16. The rapid resin or pitch transfer molding process according to claim 15, which further comprises heating to a temperature of about 1600 through about 2800°C to graphitize the carbonized impregnated preform.

10 17. The rapid resin or pitch transfer molding process according to claim 16, wherein the graphitized preform is further densified using chemical vapor deposition/chemical vapor infiltration or resin transfer molding.

18. The rapid resin or pitch transfer molding process according to claim 7, wherein a vacuum is provided to the mold prior to injecting the molten resin or pitch.

15 19. The rapid resin or pitch transfer molding process according to claim 7, wherein cooling of the resulting resin-infiltrated or pitch-infiltrated preform is effected by a flash cooling system.